

DEC 1 1921

23

PUBLIC WORKS

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BIRDSEYE VIEW SHOWING FAVORABLE LOCATION FOR AN ACTIVATED SLUDGE PLANT ON
WARDS ISLAND, NEW YORK CITY

IN THIS ISSUE

Municipal Street Cleaning in Philadelphia

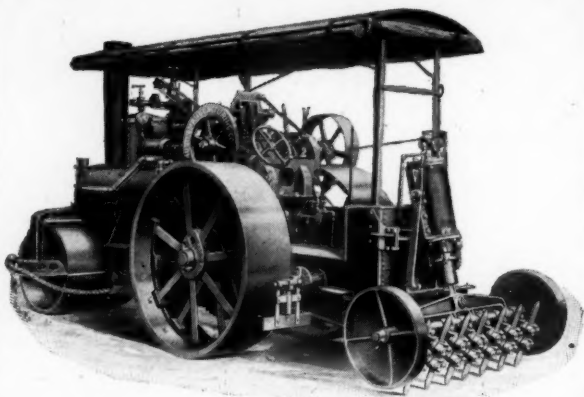
The Sanitary Condition of New York Harbor

Detroit's Municipal Automobile Equipment

How to Select and Operate Concrete Mixers

Reducing Number of Paving Brick Varieties

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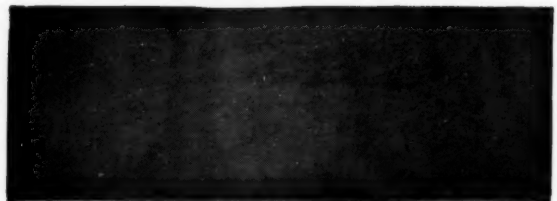
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A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 51

DECEMBER 3, 1921

No. 23

Municipal Street Cleaning in Philadelphia

This year about a quarter of the dirt, ashes and garbage collection and removal is being done by force account better and cheaper than the remainder is done by contract. Material hauled directly and by relay trucks from loading station. Skilled organization and abundant standardized equipment in service and ordered. Specialized labor, good wages and elimination of politics have reduced payrolls and turnover.

For the year 1921 Philadelphia has an appropriation of \$5,400,000 for cleaning 1,800 miles of paved streets, exclusive of Fairmount Park, which include about 300 miles of macadam, 270 miles of brick, 900 miles of asphalt and about 300 miles of granite block. Within the city limits there is a population of about 1,850,000, an area of 129 square miles, and an assessed valuation of about two billion dollars of real property. The inhabitants are 60 percent native Americans and the city districts may be roughly classified as wholesale and retail merchandizing, light and heavy manufacturing, and residential, exclusive of public parks and the extended water front on the Delaware and Susquehanna rivers, largely devoted to shipping interests.

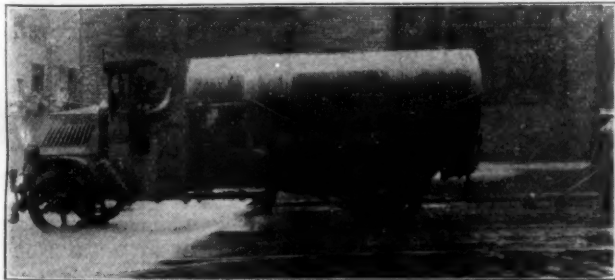
For about 40 years the city street cleaning has been done under separate contracts for collecting and removing street sweepings, ashes and garbage; most of the refuse, except the garbage, being dumped for

fill in low outlying territories. The garbage has been destroyed by incineration.

PRELIMINARY MUNICIPAL ORGANIZATION AND OPERATION

Last year a movement in favor of street cleaning by the municipal forces resulted in the recommendation by the Director of Public Works that two of the thirteen districts into which the city is divided should be cleaned by the city forces and equipment, and this plan was approved by the city council November 17, 1920.

It was impossible to provide sufficient equipment for the entire city by the first of January last, so the municipal work was restricted to two districts, 5 and 6, which include the retail business area and comprise about one quarter of the total area of the city. For this portion of the city there is available \$1,250,000 for street cleaning, which has been



MOTOR FLUSHING TANK



DIRT WAGON WITH EXTENSION SIDES



STEEL ASH WAGON—GARBAGE WAGON WITH CANVAS COVER—ASPHALT BLOCK MAN AND EQUIPMENT

accomplished by the city forces within the appropriations and with results so much better than that in the remainder of the city that the contractors for the latter area have been stimulated to improve their service.

The municipal work has been divided into three divisions under charge of its superintendent. Most of the ashes and rubbish are delivered to one of two public dumps within the city limits, where there is a capacity for about 37,000,000 yards of material (enough to provide for many years) by filling an average depth of 38 feet up to the required street level. Plans are under way for three incinerators to provide for the destruction of all the garbage. It is estimated that the materials reclaimed from refuse will pay for the cost of destruction and that the fuel in the waste matter will provide for the incineration, but oil burners will be installed to supplement the garbage fuel if necessary. Construction of the incinerators is delayed by the failure of the Council to approve any of the locations for them that have been proposed.

At present all of the ashes and street sweepings collected by the municipal forces are hauled directly in the wagons by which they are collected to the nearest dumps, excepting in Division B, where a relay station is established and the sweepings and dirt collected by the wagons are transferred to large motor trucks and hauled several miles to the dump.

When the city commenced street cleaning in January 1920 they took over the almost complete organization of some contractors, making a total force of about 850 men, among which the turnover was at first 75 men every two weeks, or about 8.7 percent, a proportion which has been reduced to 5 men in two weeks, while the total force has been reduced to about 743, retaining about 50 percent of the original employees.

By a careful arrangement of schedules to provide fair working conditions, the complete elimination of politics, a payment of wages slightly above the prevailing rate, careful instruction and selection of men, specializing of work, and the operation of the civil service system which permits discharge for cause (including inefficiency and laziness) the efficiency of the department has been greatly increased and the men are contented and reliable. The labor appropriations for this department amount this year to \$1,700,000, which at the present rate will suffice. For July the payroll was \$83,000.

DIVISION D

Division D, in the residential part of the city, is 14 squares long by 17 squares wide and has a large percent of the streets paved with asphalt. The street cleaning is done by five regular 9-man gangs, which sweep all of the streets daily. The ashes and rubbish are collected from each house once a week, the districts being divided into six parts, one of which is visited each successive day.

The asphalt streets are sprinkled two squares in advance of a pair of machine sweepers with brooms 8 feet long that proceed in battery formation, sweeping the dirt into windrows alongside both curbs. In each cleaning gang there are men that sweep the windrows into piles that are loaded by one man and helper on a cart following along each side of the street. There is also an inlet man with a rake having a handle 12 feet long, one alley man and the foreman. The motor-driven sprinkling machines have 1,500-gallon tanks with a capacity for sprinkling five blocks.

There are on this division 27 day gangs cleaning asphalt streets. Each gang has one block man with a 2-wheel pushcart carrying a steel can 19 inches in diameter and 24 inches deep, a fiber broom and a handled pan, with which droppings, rubbish, dirt, leaves, etc. are collected at the rate of about 5,000 square yards per day per man in the district, which is composed of about 40 percent residences and 60 percent tenements.

RELAY STATION

The dirt, refuse and ashes collected from Division D are hauled by teams to the station at 1120 Race street that has been established in a two-story 200 x 150-foot brick building. The lower story contains stables for 112 horses, smith shop and harness room.

The upper story is used for storage and for the delivery platform to nine 6 x 10-foot hoppers set in the floor across one end of the building.

The carts are hauled up a ramp to the second floor by an electric hoisting engine, driven around to the opposite side of the building and are backed up against a stop log and dumped into the hoppers. Five-ton motor trucks are driven from Race street across the block through an alley or driveway, passing the lower story of the building underneath the hoppers, where the trucks stop to receive their load. On signal from the driver the dump man on the upper floor pulls a cord that unlocks the bottom flaps of the hopper, which discharges its contents into the 5-ton truck, which has elevated side boards giving it a capacity of 10 or 12 yards. The trucks are loaded and passed on in about 15 seconds. They haul their loads $3\frac{1}{2}$ miles to the dump in a swamp, where three attendants direct and assist in the unloading. In winter the work for the 238 blocks included in this division is handled by 20 trucks and 30 collecting wagons that haul from 100 to 250 loads a day to the dump. In the business section of the city the streets are cleaned at night during seven months of the year.

The relay station houses 55 ash and dirt wagons, 12 machine brooms, five 4-yard steel-body ash wagons, 50 wooden Philadelphia type 2-ton dump wagons, with extension sides with a capacity to 6 yards, 5 sprinkling wagons, 12 machine sweepers (part of them of the Campbell make), and 27 asphalt cleaning equipments, each consisting of a push cart, 4 cans, broom and pan as already described.

The force employed in the relay station or working from it as a headquarters include four men on the dump floor, two men to pull the hauling cable down the ramp, one man to operate the cable hoist, two men on the street tying canvas covers over the loaded motor trucks and making them ready, fifty drivers, four stable men, five 9-man gangs of street cleaners, five dirt helpers, twenty-seven block men, two flush cart drivers, and two helpers and one sub-foreman with each street cleaning gang, one sub-foreman for the twenty-seven block men, one sub-foreman for flushing, one checker-out, one inspector who attends to complaints, one stable boss, two night stable men, one ash foreman and one helper, one street cleaning foreman, three horse shoers, one harness man and the superintendent.

Mules are used for drawing the machine brooms and horses are used in all other teams. All of the



HOSE FLUSHING GANG

stalls are double, but a few of them are divided by a skeleton partition, consisting of a longitudinal plank suspended about 3 feet above the floor.

Every horse and mule has an identifying serial number burnt on his hoof and is carefully inspected every time that he comes in from work and is shod or loose shoes tightened at night. Each horse receives 10 quarts of oats and from 17 to 20 pounds of hay twice a day, the oats being fed at six or seven o'clock P. M. and at four A. M., and the horses being watered at nine P. M., and three times during the day. Each horse is provided with a canvas blanket for winter and a stable blanket faced with burlap outside.

The harness for each team is suspended from the ceiling by ropes and pulleys similar to the system used in fire engine houses, and is dropped on the horse's neck, the fastenings snapped together so that the horses are ready to be hitched to the wagon in a few seconds. All of the equipment in the stable is thoroughly washed once a week.

The city provides rubber hats, coats and boots for the street cleaners, black for the drivers and helpers and yellow for the block men.

In the summer the street cleaners work from 5 A. M. until 1 P. M. and the ash men work from 6 A. M. until their work is completed and from 5 o'clock until 9 o'clock P. M. for a uniform wage of \$27 per week.

DIVISIONS A AND C

Street cleaning division A, which includes the district around the city hall, is 27 blocks long and 9 blocks wide, and division C, which is mostly residential, is 14 blocks long and 14 blocks wide. In both of them the organization and operations are similar to those for division D, except that divisions A and C have each of them only four cleaning gangs. In division A about one-half of the work is done during the daytime by the broom men and the other one-half by the machine sweepers at night. In the summer time the day workers collect about 24 wagon loads of dirt and the night forces about 22 3-ton truck loads. The average total collection in the summer is about 50 to 60 wagon loads of dirt and rubbish and in the winter from 150 to 180 loads.

The equipment at the station for this division includes 69 horses, 20 mules, 12 machine brooms each drawn by two mules, 10 4-yard steel 2-ton dirt wagons, 50 Miller and Philadelphia 4-yard wooden rubbish and ash wagons, 11 3-ton Mack trucks for ash collecting and night dirt collecting, 200 hand brooms, one dozen machine brooms, and 150 shovels.



STREET CLEANING GANG WITH MACHINE BROOMS

The average force consists of 100 block men, six 10-man street gangs, six inlet men, four flushers, one 8-man hose gang, eight stable men, two night watchmen, four wheelwrights, two horse shoers, two wagon blacksmiths, two helpers, one street cleaning inspector, one stable foreman, one street cleaning foreman, one dump man, eight sub-foremen, one general foreman and one superintendent. The equipment and forces for division C are similar to those of division A.

PROPOSED DEVELOPMENTS

In addition to the equipment already enumerated, the city is purchasing a large amount for cleaning the remaining eleven districts for which the cleaning contracts will expire January 1st. Among proposals already received are those for 35 5-ton trucks, 20 motor flushers, 30 motor-driven ash trucks, besides tractors, snow plows and motor-driven street sweepers and 300 horses. It is proposed to establish three transfer stations, where the ashes may be transferred from collecting wagons to motor trucks in which they will be hauled a distance to be dumped. These will be located at the same points where the incinerators are to be established.

The collection and incineration of garbage and rubbish would be more rapid and less costly and the city would present a much better appearance if the efforts of the street cleaning department were more generally and efficiently seconded by the citizens themselves. Although they are required by law to place garbage in water-tight closed metal containers they are often inclined to wrap it up loosely in paper and throw it in the alley, there to be disintegrated, scattered and decomposed rapidly, making it difficult to collect and breeding flies and foul odors, besides presenting a very unwholesome appearance.

The education of these people to conform to the law and observe sanitary methods is slow and troublesome, but it is somewhat accelerated by police co-operation that resulted, last year, in about 500 arrests, mostly of foreign born citizens, for violating the sanitary regulations, for which, on conviction, they have to pay fines and costs, amounting to usually \$14 or \$24 each—punishment which has a more salutary effect than a long campaign of persuasion.

Preliminary Announcement of Highway Work

Under date of November 19th the division of highways of Massachusetts issued a circular to contractors relative to highway construction proposed for 1922, with the object of permitting contractors to make preliminary investigations of the work sufficiently in advance of the requests for bids. This plan was inaugurated by the Massachusetts Department of Public Works a year ago and it believes that to this move can be credited a portion of the satisfactory results secured in carrying on the work of 1921, which is now practically completed.

Such progress has been made by the department, in planning the 1922 work that many projects are practically decided upon and the plans had been sufficiently advanced to inform contractors relative to the engineering requirements. "It is desired that contractors who are interested in highway construction for this department in 1922 should immediately get

in touch with the chief engineer, learn of projects definitely decided upon, be advised as to location and amount of work proposed, and supplement such information by their own investigations at the different locations. This preliminary investigation is expected to place contractors in a position to submit intelligent bids early next spring and thus aid in securing an early start in construction work for the season."

Information given at this time is not guaranteed to be final but is subject to possible changes. As even the type of surface and character of construction may be changed, the commissioners suggest that contractors, in their investigations, should contemplate the different types of standard construction and surface that now prevail in the department, in order to be prepared for bidding upon any of the standard types of construction.

The Sanitary Condition of New York Harbor *

By Kenneth Allen†

During the past ten years there has been a steady depletion of dissolved oxygen in harbor waters and the situation is now grave

New York can discharge its sewage unpurified into adjacent water with much less danger of creating a nuisance than most cities, but the time is approaching when something on a larger scale than heretofore attempted must be done if certain areas of the city are not to pass through a period of discomfort and with unsanitary living conditions such as many cities have experienced to their sorrow.

The unusually thorough and extensive series of investigations of the New York Bay Pollution and Metropolitan Commissions placed the situation squarely before the public, and with the opinions of the experts called in by the latter commission and in connection with the suit of the State against the State of New Jersey and the Passaic Valley Sewer Commissioners, furnish ample ground for apprehension.

Such high authorities as Dr. J. Gilbert Fowler of Manchester and John D. Watson of Birmingham, England, Professors Olin H. Landreth, C. E. A. Winslow and W. P. Mason and Past-President Desmond Fitzgerald of the Am. Soc. C. E. were particularly emphatic in their statements. In the opinion of Professor W. T. Sedgwick, "There will surely come a time when the comparatively innocuous fermentation which now goes on in these bodies of water in the presence of dissolved oxygen will, by absence

*Paper before the American Society for Municipal Improvements.

†Sanitary Engineer, Board of Estimate and Apportionment, New York City.

of such oxygen, pass over the evil-smelling, unsightly, disgusting and dangerous putrefaction, with the result that what is now a comparatively decent and unobjectionable body of water will become a public nuisance and cry loudly for relief."

Now these opinions were expressed about eight or ten years ago, and it may be interesting to compare conditions as they are today with those that obtained then.

Superficially, as evidenced by sight and smell, the difference in the situation is not marked. Along the slips, and especially in the Harlem and Lower East rivers, it is normally disgusting to those whose attention is directed to it; and at times, on warm damp summer evenings, a faint but characteristic sewage odor permeates the atmosphere along those streams. In cool weather, on the other hand, the only evidence of pollution is by vision, the water being cloudy at all times along the shores and carrying more or less scum with solids of sewage origin, both coarse and fine.

In the early investigations of the Metropolitan Sewerage Commission various tests of the harbor water were made, in which those for the ammonias, nitrates and nitrites as well as for bacteria were prominent, in accordance with current practice. But beginning in 1909 emphasis was laid on the test for dissolved oxygen, now generally recognized as the most illuminating of all tests for the pollution of water. These determinations were kept up until the termination of the Commission's work in 1914 and have since then been continued by the Board of Estimate and Apportionment, under the direction of the chief engineers, Nelson P. Lewis and Arthur S. Tuttle.

As is well known, clean river or ocean water is usually nearly saturated with dissolved oxygen absorbed, for the most part, from the air. On mixture with polluting organic matter, such as sewage, the contained bacteria use up this oxygen in their life processes with an avidity dependent upon their concentration (degree of pollution) and the temperature. Owing to their dormant condition in winter, there is little draft on the oxygen, which remains high in the main channels in spite of a relatively intense pollution; but in the summer their effect is readily recognized as a function of the pollution.

For this reason it has seemed undesirable to attach great importance to other than warm weather tests, and for practical reasons these have been limited in this discussion to the four months following the first of June. The averages for the several main branches of the harbor as determined up to 1921 are given in the following table.

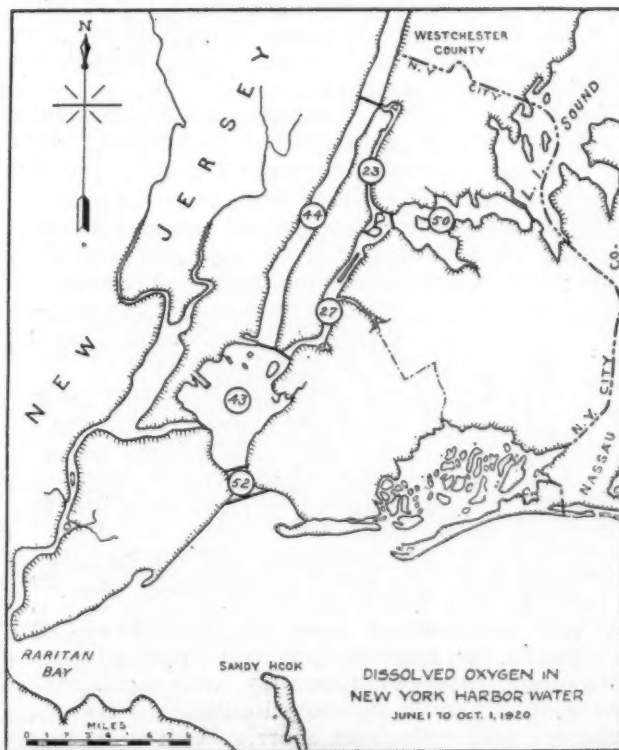
Average Percent Saturation with Dissolved Oxygen of the Water in the Main Branches of New York Harbor

Year	Hudson No. Samples	below Spuytten D.	Harlem River	Upper East R.	Lower East R.	Upper Bay	Kill van Kull	Narrows
1909	404	72	53	86	65	67	70	83
1911	861	62	42	69	54	72	70	76
1912	150	58	40	64	65	71
1913	380	57	29	..	43	66	65	69
1914	477	50	30	50	40	71	..	68
1915	247	43	28	..	33	72	..	78
1916	176	46	24	..	26	64	..	63
1917	257	42	22	47	29	50	..	63
1918	60	54	23	50	21	56	..	61
1919	322	36	29	30	24	51	35	58
1920	294	44	23	50	27	43	42	52

Although the depletion has not been uniform, the general impairment of the quality of the harbor water is quite apparent; and if it is recognized that when the degree of saturation remains less than 30% for several days in warm weather, local nuisances are probable, and that with sustained total depletion an intolerable condition would result, the gravity of the situation is obvious. For it is to be remembered that the above figures are averages and that there are times nearly every summer when certain stretches of the Harlem river are entirely devoid of dissolved oxygen and when the saturation in parts of the Lower East river lies between 5 and 15 percent.

For several years prior to the dissolution of the Metropolitan Sewerage Commission in 1914, a number of influences served to focus attention on the matter of relief of the pollution of the harbor. Aside from the voluminous publications comprising the findings of the commission, there were the hearings in the Passaic Valley Sewer Case, decision on which by the U. S. Supreme Court has recently been handed down and in which many of the most eminent American sanitarians testified. Then there was a study of the subject by Col. W. M. Black and Prof. Earle B. Phelps and, later, the establishment, under the Board of Estimate, of the New York Sewer Plan Commission followed by the Bureau of Sewer Plan. These were all instrumental in attracting attention to the subject.

For the past few years there has been little or no agitation in furtherance of improved sewerage, but the value of earlier investigations has been conserved and studies for the collection and treatment of sewage extended by the Board of Estimate and Apportionment in such a way as to conform to the development of the city and to improvements in methods of sewage treatment.



DISSOLVED OXYGEN IN NEW YORK HARBOR WATER

In addition to this a number of projects for the interception or treatment of sewage have been officially adopted which, if not already carried out, will be put under contract at an early date. Among these are the fine-screening plant at Dyckman street and the reconstruction of sewers in the Clarkson street district, with interception to a fine-screening plant at Canal street, Manhattan; the construction of submerged outlets for Truxton street, Tiffany street, Farragut street, and Old Ferry Point sewers in The Bronx; the interception from a large area in northern Queens to an outlet off Theodore street; the sewerage of the Rockaways with an outlet off Beach 149th street, Queens; the establishment of a fine-screening plant at Paerdegat in Brooklyn, and the interception, with fine-screening and disinfection, of the sewage from a large area near Midland Beach and South Beach in the Borough of Richmond. All of these improvements have been in conformity with the general plan as developed in the office of the chief engineer of the Board of Estimate and Apportionment at the time of their adoption.

The earlier studies of the Metropolitan Commission comprised the entire Metropolitan area lying within 20 miles of the New York City Hall, covering 700 sq. mi.—a perfectly justifiable proposition, since the pollution of the harbor is derived from the whole of this larger area. But failure to secure the co-operation of the New Jersey authorities led to the restriction of their plans to New York. The outstanding features of these plans were as follows:

- (1) The disposal of a large volume of sewage tributary to the Harlem river and from neighboring territory in Manhattan and The Bronx or Wards Island by sedimentation.
- (2) The transfer of another large volume tributary to the Lower East river and the North shore of Jamaica bay to an artificial island about 3 miles south of Coney Island where, after tank treatment, it would be discharged into the lower bay; and
- (3) The collection of sewage from the remaining territory in all boroughs to selected points, where it would be treated—usually by fine screening or sedimentation.

Owing to a strong opposition to some of these features which developed at the time, the New York Sewer Plan Commission proposed as an alternative:

- (1) The diversion by tunnel of the sewage tributary to the Harlem river to a point in the Hudson off West 155th street;
- (2) The substitution of an artificial island off Red Hook—just south of Governors Island in the Upper Bay—for the more remote outlet in the lower bay off Coney Island, except that the sewage would all be taken from the East side of the river.
- (3) Local plants to provide for the balance of the city's sewage, as in the former plan.

These modifications were all feasible and that relating to the Harlem river was approved by the Bureau of Sewer Plan in 1915, with treatment by fine-screening and a submerged outlet in the Hudson nearly a half mile from shore. With a discharge forecast at over 100,000,000 gallons per day at this

one point it is quite possible that some further treatment should be anticipated during periods of extreme drought.

Plans for the disposal of the sewage from that part of Brooklyn fronting on the East river have remained in abeyance, although this, to a considerable extent, controls the plan for the rest of the Lower East river and the upper bay.

The "Ocean Island" project of the Metropolitan Commission was objected to on account of the high first cost made necessary by the construction of a large tunnel, some 12 miles long, to the point of disposal before starting operation. On the other hand, a discharge to the upper bay, in order to produce an equivalent result, would involve a higher degree of purification for the sewage, would in any case increase the local pollution, near the outlet, close to the main ship channel, and furthermore, it has been questioned whether the Federal authorities would consent to the construction of a new island on what is now an important anchorage ground. Such an island has, nevertheless, been recently proposed in the interests of commerce.

It is suggested, however, that a way out of this dilemma may be found in the following plan:

There will be tributary to Wards Island from the three neighboring boroughs an estimated volume of 142 million gallons of sewage per day by 1960. It has heretofore been the plan to treat this by plain sedimentation and to employ this method at the several plants to be established along the shores of the Lower East river. By this means but one-third of the putrescible matter would be removed, while it would be very difficult to find sufficient area for the local plants.

It is believed that experience with the activated sludge process has reached the stage when it may be said to be established as a standard method of treatment and one that produces a very superior quality of effluent. It is true that the question of dewatering the surplus sludge has not been fully solved and that the sludge from some sewages is much more amenable to treatment than that from others. Careful preliminary tests of activation and dewatering would therefore be necessary before any final commitment to this scheme; but it may be pointed out that the activated sludge process has already been or is about to be used at Worcester, Manchester and Reading in England and Milwaukee, Houston and the Chicago Sanitary District in this country, besides a number of smaller towns.

Now, if an activated sludge plant were substituted for plain sedimentation at Wards Island the well-oxygenated effluent would be such that in all probability:

- a. Local treatment could be substituted for interception either to the lower bay or to an island in the upper bay.
- b. Fine screening could be substituted for sedimentation at those local plants along the Lower East river where land for tanks would be difficult to secure.

The strategic advantages of Wards Island as a point of disposal are great. It lies close to three boroughs, two of which are densely populated in this vicinity, while the deep, turbulent waters of Hell

Gate offer ideal conditions for rapid diffusion and dilution of the effluent.

(A reproduction of a birdseye view showing the Wards Island location is given on the front cover of this issue.)

The dried sludge, rich in nitrogen, would appear to command a market as fertilizer which would go far toward offsetting the costs of operation. Unfortunately charges for power in New York are high, so that the whole subject would require careful analysis from the financial standpoint. But the prospect of reaching a satisfactory solution for this very vexed problem would seem to be sufficiently promising to justify a careful investigation of this plan.

As indicated on the accompanying cut, there is a corner of Wards Island cut off from the rest by the N. Y. Connecting R. R., upon which a disposal plant could be most advantageously located. The land is vacant and of moderate elevation above tide level. No other such area is available in this vicinity. Although publicly owned, its value for other purposes in this central location is such that an increasing demand for its occupancy seems inevitable in the near future, and if it were thus made unavailable for purposes of sewage disposal the city would, in all probability, be obliged later to expend a greatly increased sum to provide facilities elsewhere.

To conclude, it may be said that the situation regarding harbor pollution has received careful and continuous attention for nearly twenty years; the main facts are known and recognized, and with the exception of the above problem relating to the lower East river, the general features of a plan for main drainage and sewage disposal for New York are pretty well defined. Progress in carrying out physical improvements was delayed here as elsewhere by the war, but what has been accomplished in recent years has been in line with the general plan, so that the city will not be called upon to abandon or reconstruct the work at a later date.

Detroit's Municipal Automobile Equipment

More than 550 trucks and passenger cars to have efficiency increased and maintenance reduced by construction of city garage. Special features developed, accurate records kept, and standards adopted

During the past six years the city of Detroit has used automobile cars and trucks in increasing numbers, and has kept up a systematic record of their performance, cost, durability and other principal data from which comparisons have been made, deductions drawn and the conditions analyzed for the determination of general requirements, developments of special features and the establishment of stand-

ards that have resulted in the adoption of two makes for all the light and heavy duty cars and trucks owned and operated by the city.

The motor transportation of the city is under the control of Werner Helmboldt, manager, under whose direction plans have been prepared for the construction of a three-story garage with 270,000 square feet of floor space for the storage and maintenance of the city vehicles now kept in seven different garages. The first floor will be devoted entirely to motor trucks, the second floor to passenger cars, tractors and motor cycles, and the third floor for repair shops and stock room with a machine shop, paint shop, battery and magneto shop and an experimental department. These advantages will eliminate duplication of accounting and other parts of the work and will keep the repairs strictly under supervision, make them in a uniform highclass manner, reduce the time lost in waiting and save the profits paid for outside services. It will also permit concentrating purchases of accessories, insure wholesale prices and the opportunity to buy large quantities on favorable markets.

Of the 238 motor trucks now operated by the city 87 are of the Packard make, which has now been adopted for all heavy hauling. Under the present system a number of important developments and convenient improvements have been made in the trucks for the different city departments.

For the water department service trucks of the size EF are equipped with caterpillar tires, weather proof cabs, vertical hoists and 5-yard dump bodies with double acting tail gates and two hooks front and rear. Four other trucks of the same size are equipped with bolsters for the transportation of pipe, and a size EC truck is equipped with a power takeoff, vertical capstan and a 15-inch stake and rack removable side body for handling surplus pipe left in construction jobs. With this truck two men will load a 24-inch pipe in one-third of the time formerly required by six men without the special truck. When not in duty on this service the capstan is protected by a shrouder hood and is used for supply and deliver duty.

In the asphalt division the fleet of 15 EF trucks with a 5-yard capacity keep the binder or asphalt in plastic condition for 6 hours as compared with a maximum of 2½ hours with the old type of equipment, and have displaced about 100 teams. At the present time the equipment is laying from 400,000 to 500,000 yards of asphalt per year with an average haul of about 5½ miles.

A truck equipped with a power driven key opens and closes large water gates in 48-inch mains in one-fifth of the time formerly required to do the same work with from 4 to 8 men instead of the 2 men required on the truck.

Four trucks with long wheel bases, 8-passenger cabs, and compartment bodies are used by the permit department for emergency in patch work. They carry a full crew of 8 men, tools and a miscellaneous load of bricks, cement, gravel and all other requisites for completing the job with one trip, and on heavy traffic streets it is estimated that the trucks have paid for themselves during the current year.

In the garbage department there are 5 size ED trucks with special 135-cubic foot welded-seam

bodies, each of them doing as much work as could be accomplished by six horse drawn carts.

Specially equipped trucks are also used in various other departments of the city for fire and police service and for the lighting commission, one of the latter trucks having a power winch with a capacity of 10,000 pounds on a single line pull. More than 35 percent of the trucks now operated by the city are Packard trucks.

1922 Road Building in Michigan

It is planned to improve nearly 1,000 miles of road in Michigan next year, 300 of which is to be paved. It is estimated that the total expenditure will be \$13,137,000, of which the state will pay \$10,378,425. If, as is expected, an additional \$2,250,000 is received from the federal government, the building program will be extended so as to approximate \$15,000,000. Most of the work will be in the northern counties of the state, which so far have been comparatively neglected in the road building program.

Pittsburgh's Highland Reservoir No. 2

It will be remembered that last summer leaks in Highland reservoir No. 2, of the Pittsburgh water system, which has a capacity of 128,000,000 gallons, threatened the embankments and the water was quickly drawn from the reservoir and leaks in it located. The sections where these leaks were found were re-lined, the work being completed early in November at a cost of \$50,000. Water was then pumped slowly into the reservoir which has a depth of about 33 feet. Before the water had reached a depth of 14 feet the engineers estimated that the leakage was as great as before the repairs were undertaken and that more than 2,000,000 gallons a day were escaping. It seems probable that it will be necessary to entirely re-line the reservoir at a cost which is estimated to be about \$350,000.

Highway Appropriations in New York

We are advised by the state highway commission of New York that, although appropriations for 1922 will not be made until after the legislature meets in January, it is hoped and expected that they will immediately appropriate \$5,000,000 to meet the federal appropriation. In addition to the \$10,000,000 which will then be available, there is still left about \$4,000,000 of the second \$50,000,000 bond issue funds.

In addition to the above sum for construction work, the commission is preparing to submit to the legislature a maintenance program and will probably ask for at least \$7,500,000 for this purpose, that being the sum appropriated for the calendar year of 1921.

More Than \$76,000,000 for Highway Construction

Advices received up to a few days ago by Secretary Hoover from the governors of thirty of the states indicated that these states expect to undertake the construction of 6,261 miles of highways as a direct result of the recent passage of the federal highway act. This work will involve the expenditure of \$76,400,000 and employ more than 150,000 workers.

This information was furnished in reply to a letter from Secretary Hoover asking each governor what amount of work his state could get under way within a period of 90 days after the passage of the act. Some of the larger figures are as follows: Texas—700 miles costing \$8,000,000 and employing 13,500 workers, Georgia—360 miles costing \$5,000,000 and employing 9,000 men. Indiana can use 5,800 men, Michigan 5,600, Ohio 5,300, North Carolina 5,000, Minnesota 4,350, and Louisiana, North Dakota, South Dakota and Mississippi 4,000 each.

In addition to the men directly engaged in road building there will be many others employed in quarries, cement mills, sand banks, asphalt plants, gravel pits and shops manufacturing road building materials and tools.

Many of the northern states have reported that weather conditions will not permit beginning road construction within 90 days, these including Connecticut, Maine, New Hampshire and Wisconsin. Others are unable at present to meet the federal appropriation with state funds.

Rapid Highway Concreting in Missouri

The Special Road District of Joplin made the record for concrete construction in Missouri in one day when Superintendent Hancock, with a gang of 22 and a Koehring Mixer, laid 520 feet of slab. This work was done under the supervision of John M. Malang, whose average has been 400 feet per day of 18-foot concrete pavement 8 inches thick in the center and 6 inches at the edge.

Mr. Malang is favored by two things in his road building operations. One is the fact that he is working in flat country over an old roadway surface and the other that he is using the "chats" in his mix. These chats are lying all along the job and it is not necessary to haul them more than 1,000 feet. They are easy to work in concrete and with a proportion of 1:1½:4 the concrete mixes well and takes on a fine finish. The mix is as dry as possible; the finisher follows close behind the mixer, and the little water that comes to the surface quickly evaporates.

With a crew of 22 men Mr. Malang has kept up a consistent record and now that James Hancock, formerly in the State Highway Department, has been placed in charge of the slab work, it is making great progress toward a finish.

Mr. Malang declares that he can build a similar highway in other parts of the state for \$25,000 per mile, which is locally considered about the most reasonable piece of concrete work that could be done at the present time. It is at the rate of \$5,000 per mile less than Illinois contracts have been let. The Governor of that state recently took great satisfaction in bringing down the price of concrete construction to \$29,000 per mile. Here in the Joplin district under the supervision of Mr. Malang the pavement, eighteen feet in width is being constructed at a cost slightly exceeding \$20,000.

The Kansas overseers were willing that the Joplin District should build a stretch for them. On a three-mile project in that state the Joplin men underbid the lowest by \$67,000, or just about half the price. The road will connect the Missouri project out of Joplin.

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CONTENTS

MUNICIPAL STREET CLEANING IN PHILADELPHIA—Illustrated	425
Preliminary Announcement of Highway Work.....	428
THE SANITARY CONDITION OF NEW YORK HARBOR—Illustrated—By Kenneth Allen.....	428
DETROIT'S MUNICIPAL AUTOMOBILE EQUIPMENT	431
1922 Road Building in Michigan.....	432
Pittsburgh's Highland Reservoir No. 2.....	432
Highway Appropriations in New York.....	432
More Than \$70,000,000 for Highway Construction.....	432
Rapid Highway Concreting in Missouri.....	432
EDITORIAL NOTES	433
Pollution of New York Harbor—Engineering Advantages in Municipal Consolidation.	
REDUCING NUMBER OF PAVING BRICK VARIETIES	434
HOW TO SELECT, INSTALL AND OPERATE CONCRETE MIXERS	435
Retained Percentages on Contracts.....	438
Wells for Road Drainage	438
Build No Roads Less Than Eighteen Feet Wide.....	438
RECENT LEGAL DECISIONS	439

Pollution of New York Harbor.

If a bridge is designed for a certain load and the traffic crossing it continues to exceed the safe load by continually increasing amounts, the bridge will sometime break, in some part or as a whole. Meantime, to those using it there is nothing to indicate that the margin of safety is continually growing smaller, but the engineer can determine this by measurements and calculations.

There is similarly a limit to the amount of pollution that can be added to a given water without creating a nuisance. Until that limit is reached there is little to tell the senses of the approaching calamity; but once it has been passed, putrefaction with attendant unpleasant sights and odors will surely occur.

Apparently New York harbor is approaching close to that limit; in fact, parts of it now reach and pass it for occasional short periods. And nothing really effective has been done, nor plans adopted, to delay the day when the harbor's pollution will be unpleas-

antly apparent to all who travel over it or dwell on its shores.

In an article in this issue Kenneth Allen presents figures that demonstrate this approach of the danger point. Using the dissolved oxygen as a measure, it is shown that between 1909 and 1920 this had fallen from 83 per cent of saturation to 52 at the Narrows, from 67 to 43 in the upper bay, from 65 to 27 in the lower East river, and 55 to 23 in the Harlem river. Thirty per cent is considered about the danger point, and it is seen that both the Harlem and lower East rivers have passed that point, and the upper bay is not far behind. Considering how long it requires to construct works of the magnitude needed by New York, objectionable conditions can hardly be avoided unless actual work be begun at once on some plans for reducing the pollution.

Engineering Advantages in Municipal Consolidation

The citizens of Newark, which is really a metropolitan center of its own rather than a suburb of New York and one of the large cities of the country, are discussing the subject of the consolidation with that city of many of the surrounding communities which have been built up so solidly to their mutual boundaries that the entire area is in effect a continuous community.

While the matter of local pride probably actuates the Newark citizens toward consolidation and may influence those of the other communities against it, there are practical physical arguments in its favor. For instance, the topography is such that considerable confusion and difficulty is encountered in some cases in planning and constructing sewerage systems separately for the different communities. In fact, there are several instances of co-operation of adjoining communities in this district in the construction of joint sewers. Much difficulty and delay in these matters in the past could have been avoided by political consolidation, and undoubtedly such consolidation will have similar advantages in future construction.

Another advantage will be in connection with the water supplies. Some of the communities involved in the proposed consolidation are already suffering from a shortage of supply and uncertain as to where additional supply can be obtained. On the other hand, Newark and possibly one or two of the other communities have available, if not already developed, more water than they need. With consolidation, a re-distribution would undoubtedly be effected which would solve the problem for communities where it now exists.

Refuse disposal also can be considered as a joint problem and the location of disposal plants could be decided upon more economical grounds than at present, when each community indignantly refuses permission for the location within its area of plants of any kind for disposing of the refuse of adjoining communities.

In addition to the solving or rendering less difficult of these and other problems, the consolidation should permit of considerable increase in efficiency and reduction in operating expenses through elimination or unnecessary duplication of overhead, and the

employment of higher grade officials for the operation of the public utilities than can be afforded by some of the smaller communities.

Reducing Number of Paving Brick Varieties

Manufacturers and engineers meet at the invitation of the Department of Commerce and reduce the varieties of paving brick from 66 to 11.

On November 15th there was held in Washington, D. C., a conference called by the United States Department of Commerce with a view to reducing the varieties of standard sizes and types of paving brick, which was called by Commissioner Hoover as the result of requests for his aid in the matter made by the National Paving Brick Manufacturers' Association. This conference decided upon immediate results along the desired lines and prepared a way for even further reduction.

The N. P. B. M. A. had compiled, by Secretary M. B. Greenough and with the aid of 44 of the largest manufacturers of paving brick, a list of the various sizes and types of brick that had been actually shipped by the manufacturers reporting between 1914 and 1921 inclusive. This tabulation showed 66 varieties of brick, which the conference agreed to reduce to 11, to be considered as standards.

Of these varieties, 8 were plain wire cut brick (vertical fibre lugless), 23 were repressed lug brick, 4 were vertical fibre lug brick, 7 were wire cut lug brick, a total of 42 varieties for regular use. In addition there were, known as special brick, 4 Hillside brick, Dunn wire-cut; 3 Hillside brick, repressed; 8 street railway brick, and 9 miscellaneous.

Not all of these 66 varieties were actually manufactured by the firms reporting in any one year, but in 1916 52 of them were in use, which number had been decreased to 46 in 1917 and to 36 in 1921; almost all of the reduction having been in the brick known as specials and in the repressed lug.

In reducing the number of standards, no combinations or compromises were introduced, but the reduction was obtained by elimination of those in less common use or apparently unnecessary. The committee felt that the present demands are such that there must be placed at the disposal of engineers brick having depths of either 3, $3\frac{1}{2}$ and 4 inches, since the smaller cities want the first, the large cities require the 4 inch, while the state highway departments are demanding a $3\frac{1}{2}$ -inch brick. The committee considered it desirable to so reduce the number of sizes that all of them could be cut out of a clay column either 3 inches or 4 inches high, but the $3\frac{1}{2}$ -inch brick seemed to be necessary, for the present at least.

The committee also eliminated as standards all the various classifications of special brick except the Hillside type, which was deemed of sufficient importance to retain one size in the Dunn wire-cut and one in the repressed.

THE STANDARDS ADOPTED

With all the eliminations made, there are four standard sizes left as follows:

$3\frac{1}{2}$ x	4	x	$8\frac{1}{2}$
3	x	4	x $8\frac{1}{2}$
$3\frac{1}{2}$ x	$3\frac{1}{2}$ x	$8\frac{1}{2}$	
$3\frac{1}{2}$ x	3	x	$8\frac{1}{2}$

No one type of brick, however, will use all of these sizes. The plain wire-cut brick will be made in $3 \times 4 \times 8\frac{1}{2}$ and $3\frac{1}{2} \times 4 \times 8\frac{1}{2}$. The repressed lug brick will be made in $3\frac{1}{2} \times 3\frac{1}{2} \times 8\frac{1}{2}$ and $3\frac{1}{2} \times 4 \times 8\frac{1}{2}$. The vertical fibre lug will be made in $3 \times 4 \times 8\frac{1}{2}$ and in $3\frac{1}{2} \times 4 \times 8\frac{1}{2}$. The Dunn wire-cut lug will be made in $3\frac{1}{2} \times 3 \times 8\frac{1}{2}$, in $3\frac{1}{2} \times 3\frac{1}{2} \times 8\frac{1}{2}$, and in $3\frac{1}{2} \times 4 \times 8\frac{1}{2}$. The Hillside brick, both Dunn lug and repressed lug, will be made in $3\frac{1}{2} \times 4 \times 8\frac{1}{2}$.

In adopting these sizes as standard, the conference added the resolution that "The sizes stated in this report are to be regarded as nominal and subject to the usual variations of $\frac{1}{8}$ -inch in width and depth and $\frac{1}{2}$ -in in length.

The committee believed that further reduction of varieties is desirable but that this should follow only after further study and after the idea of standardization has become well impressed on the paving field.

ATTENDANCE AT THE CONFERENCE

The conference was attended by representatives of the American Association of State Highway Officials, American Ceramic Society, American Electrical Railway Engineering Association, American Engineering Council, American Engineering Standards Committee, American Institute of Architects, American Institute of Mining and Metallurgical Engineers, American Society of Civil Engineers, American Society for Municipal Improvements, American Society for Testing Materials, Columbus Engineers' Club, Federated American Engineering Societies, Indiana Engineering Society, U. S. Chamber of Commerce, Western Society of Engineers, and the following U. S. departments: Bureau of Standards, Department of Agriculture, Department of Commerce, Department of the Interior, Navy Department and War Department. Six engineers attended as individuals and there were nine representatives of the paving industry.

After the address by Secretary Hoover, Mr. Greenough read the report of the N. P. B. M. A. giving the result of his canvass of the manufacturers showing the varieties that were produced by them, following which the chairman appointed for the actual work of elimination of varieties a committee comprising F. B. Dunn, Leon C. Herrick, P. H. Bates, O. W. Renkert and, as chairman, E. J. Mehre.

Following the adoption of the report, it was decided to appoint a committee of 10 to insure that the standardization embodied in the resolution of the conference is carried out, that constant contact between the various organizations and manufacturers represented at the conference and the Department of Commerce be continued, and to effect further eliminations in the remaining varieties when possible. This committee is to be composed of representatives from the American Society of Civil

Engineers, American Association of State Highway Officials, American Society for Municipal Improvements, American Society for Testing Materials, Federated American Engineering Societies, National Paving Brick Manufacturers' Association, Chamber of Commerce of the U. S. A., Bureau of Public Roads, Bureau of Standards and Department of Commerce.

In addressing the conference, Secretary Hoover said: "If the engineers who direct the work in our cities and the manufacturers will co-operate in reaching such a conclusion under theegis of the Department of Commerce, there can be no criticism of anybody engaged in this work; and if we can secure that co-operation we will secure at the same time progress in the industry itself, and not by any compulsion from the top, so that I look upon this meeting with more than usual interest because it is the first of those processes that we have brought to this stage." He referred to the difficulty of entering into trade agreements because of the possibility that they would violate some of the trade acts, and to the fact that the present administration of the Department of Commerce had felt that it could perform a service to manufacture if it acted as a center point about which their own co-operative action could take place.

FIGURES OF THE PAVING BRICK INDUSTRY

The report of the N. P. B. M. A. contained, in addition to the figures already given, very complete data concerning the entire brick industry during the past eight years. During each of the first three of these years the aggregate shipments of the companies reporting amounted to between 450,000,000 and 460,000,000 brick. Shipments fell off slightly in 1917 and in 1918 there was a sharp plunge to the lowest figure of the period, only 236,000,000 brick being shipped. In 1919 the shipments returned to 325,000,000, fell to about 300,000,000 in 1920, while figures up to the first of October, 1921, indicated figures higher than any year since 1917—approximately 375,000,000. This would indicate practically complete recovery of the short-haul markets, but the long-haul markets can hardly be expected to recover until freight rates decline.

Other tables showed the relative popularity of each type of brick during the past eight years. In 1914 repressed lug stood at the head, with Dunn wire-cut lug second, vertical fibre lug third, plain wire-cut fourth and all special bricks classed together stood fifth. The repressed lug held first place until 1919 when it took second, plain wire-cut (vertical fibre lugless) taking first place in 1920 and 1921. Dunn wire-cut lugu held second place until 1919 when it took first place, but dropped to third place in 1920 and 1921. Vertical fibre lug brick occupied third place until 1918 and fourth place since then. All the special brick classed together have remained at fifth place throughout, exceeding 1.9% only in the year 1917, when they totaled 2.3%.

The actual percentages indicate even more strikingly the change in popularity of certain of these classes. Repressed lug brick in 1914 was sold to the extent of 71.6% of the entire output of all types, whereas in 1921 it had fallen to 25.4%. Plain

wire-cut brick meantime had increased from 5.9% in 1914 to 42.8% in 1921. Dunn wire-cut lug brick was a minimum in 1914 with 14.7%, reached a maximum in 1917 with 34.3% and in 1921 had fallen to 20.2%. The only type which has changed consistently and continuously throughout the period is the repressed lug brick, the use of which has been less each year than the year previous for the eight years recorded.

How to Select, Install and Operate a Concrete Mixer*

Charging the mixer; time schedule; accurate proportioning; removal of mixed concrete; highway concret-ing; care of machines.

CHARGING THE MIXER

Large mixers are generally permanently established, at least during the duration of the job, on a concrete or heavy timber foundation and receive the cement and aggregate through the fixed charging hopper into which the materials are delivered by batch boxes or, preferably, by gravity through chutes from storage bins. The cement being sometimes added in the same manner or emptied by hand from bags into the charging hopper on top of the aggregate.

Smaller machines are generally equipped either with a loading platform or a power loader. The price of the machine with the loader equipment used to be 35 or 40 percent less than that with the power loader. While the use of the power loader on the other hand increases the output of the machine from 20 to 30 percent and may generally be considered more efficient and economical than the platform loader for an output of 50 yards or more daily. Either type of machine can be served by wheelbarrows, hand carts, trucks, batch boxes, or by batch boxes or buckets handled by a derrick or other hoisting apparatus. The use of the platform makes more hand-work and increases the probability of lost time and obstruction that is expensive and reduces the output of the machine.

When the power loader is used the aggregate is dumped into it from the ground level and there is plenty of space for its delivery and the removal of the empty containers without delaying the work.

The importance in having the machines so arranged as to maintain a constant operation is very great and is greater the larger the proportion of hand work involved or of expensive equipment used for serving it. The probability of lost time, delay and obstruction for a small machine is much less than for a large one.

TIME SCHEDULE

For instance, a 1-bag machine will require about 5 wheelbarrows loads of cement, sand and broken stone for each charge and if this is wheeled to the

*Continued from page 420.

loading platform to make delivery it will take at least 35 seconds, which, plus a minimum net mixing time of 30 seconds and 10 seconds for discharge makes a total of 75 seconds minimum for 7 cubic feet of concrete. If the same machine has a power loader it may be filled and elevated while the concrete is being mixed thus cutting the time nearly 50 percent and almost doubling the output of the machine. With larger machines the advantage of the power loading is still greater because there is more danger of obstruction of the hand loading.

WHEELBARROW CHARGING

When the mixer is charged by wheelbarrows great care should be taken to arrange the relative position of the different materials, the mixer, and the finished concrete delivery, so that no operation will obstruct any other operation and that all of them may go on in a regular continuous cycle. Each man should be trained to perform a single duty with the fewest possible motions and to keep in time with the rest, and if any part of the work is exceptionally severe the men should take turns in performing it for a short time and then be succeeded by other men, and so on. A competent foreman should be constantly in attendance watching all the operations and providing an immediate remedy, if there is any sign of congestion, or delay and replacing a clumsy or inefficient man or a broken wheelbarrow without delay.

The most advantageous arrangement is to have the sand and broken stone supplies on opposite sides of the mixer and at a slight elevation above the charging platform and to establish a loop connecting them and the machine, allowing the sand and gravel and stone to be taken alternately to the machine, dumped and the wheelbarrow passed on to the other storage pile, reload and come back and so on, thus making no empty trips, and never turning around or delaying at the machine. If this is impracticable the wheelbarrows should pass continuously over the platform, leaving it on the opposite side to their entrance and not obstructing by turning around or passing.

CAPACITY

When properly installed and operated a mixer of $\frac{1}{2}$ -yard capacity is generally ample for mixing 1,000 yards of concrete or for an output of 150 yards or less for each 8-hour shift. For special cases or very large work the number or size of the machines or both should be increased. Great care should always be taken to arrange for the maximum efficiency of the machine by removing the concrete as rapidly as it is mixed.

For large quantities of concrete it usually pays to provide elevated storage so that the mixer can be charged by gravity, an operation which only takes a few seconds and enables the machine to be run at a maximum speed of nearly or quite one batch per minute.

ACCURATE PROPORTIONING

It is of great importance that the proportion of aggregate and cement and water should be correct and that the mixing should be thorough and sufficiently continued, but unduly prolonging it is of no material advantage. These features are usually looked after by the engineer or his inspector, who should be earnestly and conscientiously supplemented by

the contractor and his foreman, who will never derive any ultimate profit by attempts to skin the mixture, to curtail the time of mixing, to make it too wet or in case of cost-plus work to add too great proportion of cement.

If the job is one in which the contractor is responsible for proportions and qualities he should take special pains to secure uniform and properly graded aggregate and, if necessary, to mix it in order to get maximum density of output, which may require changing the mixture from time to time if the quality of his materials varies. The amount of water required is also likely to vary with differences in the aggregate and even with weather conditions and should be carefully watched and regulated.

AUTOMATIC DEVICES

The water should be admitted to the mixer through some sort of automatic device of which many are manufactured and others can be easily installed by the contractor with home-made appliances. The principal requirements are to have tanks that can be filled with accuracy to any given measurement while the concrete is being mixed and can be very rapidly discharged when the aggregate is placed in the mixer. The filling of the water tanks can be easily accomplished by an ordinary float valve, ball cock or overflow, and the water can be discharged into the mixer either by tilting mechanism or generally by any kind of a quick opening valve.

In order to secure a prescribed amount of mixing there has been placed on the market a mixer meter, which, when attached to the driving gear of the machine and properly adjusted and sealed, counts the number of revolutions of the drum and locks the gear so that the drum cannot be stopped or the concrete discharged until after the prescribed number of revolutions have been made, notice of which is given by a gong or other signal. These meters are available on the market, and an ingenious contractor or his mechanic can easily prepare a homemade device that will register the number of turns or will at least sound the alarm after a certain number of revolutions have been made. Such an apparatus is well worth while, both for the engineer and the contractor. Various more or less obvious devices besides boxes, have been successfully used for rapid and even automatic measurement of sand, stone and cement. Usually they are arranged in connection with delivery by gravity from hopper to mixer. A simple and effective one is substantially two horizontal sliding gates set far enough apart in a vertical chute to enclose between them the required volume for one batch and both are connected to the same operating lever that one is always open when the other is closed.

REMOVAL OF THE MIXED CONCRETE

All of the pains taken to select, install and operate the mixer will be of little avail if arrangements are not made for removing the concrete as rapidly as it is needed or as it can be delivered by the machine. This is done most positively and continuously when the machine can be placed at such an elevation that it delivers directly into a chute through which it is spouted to the required position, the lower part of the chute or if necessary all of it being moveable so as to distribute the concrete as required. This is often available in pit, trench and foundation work,

in sewer work and the like. For work above ground level approximately similar results can be obtained by the use of a hoisting tower and spouting by which the concrete can be lifted to a maximum height of 200 or 300 feet and delivered to any point within a radius as large or larger than the elevation above the point of delivery.

Large quantities of concrete can also be handled by delivering it directly from the mixer to side or end dump cars on an industrial track high enough to enable them to dump directly into the forms and arranged so as to return on a loop and always have an empty car ready to receive the concrete as soon as a loaded car is moved away.

If circumstances do not permit the cars to place the concrete in the forms, flat cars may be used carrying 1, 2, 3 or 4 buckets, and the latter may be removed from the cars and swung to position and dumped as required by derricks, cableways, locomotive cranes or their equivalent. The mixer may also be served, as is often the case on smaller jobs, directly by the same derrick that handles the concrete buckets to position returns them and often, at intervals, is able to fill the charging bin or handle aggregate directly to the charging hopper providing the amount of concrete is comparatively small, so that one derrick can even unload cars, reclaim from storage, fill overhead bin and directly supply the mixer.

Ordinarily, however, if the job is of considerable size a special derrick with clam shell buckets required for unloading cars, loading the service bin or handling direct to the charging hopper, and another derrick will be kept busy handling the buckets of concrete. A cableway may also be arranged to handle either aggregate or concrete, or both.

BELT CONVEYORS

For very large and important pieces of work belt conveyors are sometimes frequently installed to handle the aggregate during the unloading, storage and reloading processes and to deliver it to the service hopper. They, of course, require to be loaded at the initial point and have a tremendous capacity when kept continuously in operation at full speed, but are costly to install and are not as flexible as a railroad or derrick system. Belt conveyors have also been used on rare occasions for delivering concrete from the mixer to the forms. Their capacity is almost unlimited, but they are not available for as many other purposes as are derricks and industrial tracks and cars.

Concrete should not be delivered in large quantities or to great distances by wheelbarrows and carts or trucks, which are meant for very small work or under special conditions or in case conditions warrant the establishment of a central storage and mixing plant from which concrete can be distributed to constantly shifting points at a considerable distance by motor trucks. In this case special pains must be taken to insure the prompt delivery of the concrete and to see that it does not suffer segregation from the vibration and shaking in transportation. This method has been used for highway construction in the city of Philadelphia and in some of the western states but opinions are divided as to the satisfactory nature of its results, some engineers highly recommending it and others objecting to it.

HIGHWAY CONCRETING

The use of concrete for the use of foundations and for the wearing surface of city and town pavements and state highways as well, has, in a very few years become widespread and important; many hundreds of miles of such work have been constructed and thousands more are to be built as fast as possible, and hundreds of millions of dollars are at this time available for such work that is strongly urged to give relief to unemployment and stimulate general construction.

It is entirely possible to accomplish this work with ordinary concrete mixing machines, but much better economy and greater rapidity is attained by the use of special paving machines that have been very rapidly developed for this purpose and are large, self contained locomotive machines of high efficiency. They are now to be had mounted on traction wheels or caterpillar traction so as to move over the subgrade from place to place under their own power and are provided with power loaders operated by the mixer engine, and with a distributing boom or chute and traveling bucket that deposit the concrete approximately in position as the machine advances. These machines are provided with small derrick booms competent to unload batch boxes and deposit them in the elevating hopper with which the drum is charged the moment the mixed concrete is delivered to the bucket. One of the machines properly handled will build several miles of 18-foot highway in one season and when worked to its capacity is a very satisfactory investment for the contractor, especially if he has many miles of road to build, a condition that is more and more favored by the authorities letting the work.

CARE OF THE MACHINE

A concrete mixer is usually subjected to about the most severe service of any kind of contractors' plant, and most of the standard makes are so sturdy that with occasional cleaning and faithful oiling they endure for months or even years, with very little repairs. Occasionally a gear may break or the ring on which the drum is supported may become worn or injured, but it is only necessary to keep new parts in reserve and carefully follow the maker's simple instructions to maintain the machine in good working order with little or no expense. Care should always be taken to wash the machine thoroughly at the close of work for the day to prevent any of the concrete from setting in the drum and to keep the exterior of the machine and buckets and chute thoroughly clean at all times when not in service.

Sometimes difficulty is experienced with the machine stopping or it may not always discharge rapidly and completely, but these troubles are likely to be due to the consistency or proportion of the concrete or to the speed of operation, and can generally be quickly remedied by intelligent adjustment or, at the worst, by appealing to the manufacturer, who is always ready to prescribe for a sick machine or to instruct the contractor or his forces in the case and operations so as to secure the best results.

Given enough work to do and reasonable care and intelligence in selecting, installing and operating the machine so that there is a minimum of waste of time, labor and material, a concrete mixer can hardly fail to be as profitable and satisfactory as it is indispensable to a general contractor.

Retained Percentages on Contracts

In a brief paper before the American Society for Municipal Improvement, E. S. Rankin, engineer of sewers of Newark, N. J., presented some figures, which had been obtained for him through the "Clearing House" of the society, showing the percentages retained on contracts by different cities.

On sewer contracts in Newark a deduction of 20 per cent is made on all monthly estimates and in addition 5 per cent of the final estimate is retained for one year and 3 per cent for two years. Mr. Rankin thought these percentages were excessive, entailing a hardship on the contractor and an additional expense to the city by means of increased bids. In illustration he takes the case of a sewer constructed last year on which the contract price was \$117,687.50. The cost of a bond, at $1\frac{1}{2}$ per cent of the price bid, was \$1,765.30. The interest on retained percentages on the monthly estimates was \$405.64 and that on the final estimate was \$575.36, a total interest on the retained amount of \$981. This added to the cost of the bond gives \$2,746.30, or about 2.3 per cent of the bid price.

Information was obtained as to the practice of 44 different cities. Thirteen of these reported that they retained 10 per cent on current estimates, 17 retained 15 per cent, 13 retained 20 per cent and one retained 25 per cent. Eighteen retained nothing on final estimates, 4 have no fixed rule and the others vary so greatly in both amount and time of retention that a brief summary of them is impossible, the amounts running from 3 to 20 per cent and the time from 30 days to two years.

The variations in retained percentage seem to be entirely independent of geographical location. On current estimates, Minneapolis retains 10 per cent and St. Paul, a few miles away, retains 15 per cent; Mercer county, N. J., retains 10 per cent, Atlantic City, N. J., 15 per cent, Bloomfield and Newark, N. J., 20 per cent; Allentown, Pa., retains 10 per cent and Oil City, Pa., 20 per cent.

Wells for Road Drainage

In the southeastern part of Missouri the country is almost absolutely flat, the highest land being a so-called ridge about 10 feet higher than the general level, on which is located a part of the "King's Highway." In constructing this highway there was no way apparent for carrying off the surface water, by ordinary methods and the use of wells on both sides of the road was adopted.

These wells are built of 36-inch vitrified pipe, sunk vertically in the ground to a depth varying from 17 to 20 feet. At that depth a coarse sand is found which receives and removes the water that reaches it through the wells. So far as advantage has been taken of this water-absorbing capacity, no limit to it has yet been discovered. There is an average of a little more than one well to each of the 20 miles of the road. The water is lead to these wells in the ordinary way.

This method of disposing of surface water had

been employed in southeastern Missouri at a number of points for a great many years and had been found to be the most satisfactory method of disposing of surface and drainage water. The highway wells have so far been entirely satisfactory and keep the surface of the ground practically clear of water, even when severe rains occur.

Build No Roads Less Than Eighteen Feet Wide

State Highway Commissioner H. E. Sisson, of New York State, advises the people of Pennsylvania against the construction of roads less than 18 feet in width.

"Some weeks ago," says the New York Highway Commissioner, "I came into Pennsylvania on a mission of discovery. I was agreeably surprised at the progress being made by this state. Shortly after I arrived home I received clippings from several newspapers in Pennsylvania showing that agitation had been started for the construction of narrow roads, on the presumption that they would be cheaper to construct, and, therefore, could be put down for a greater mileage. In other words, it was erroneously suggested that Pennsylvania could get twice as many miles of nine-foot roads as of 18-foot roads.

"New York state is not building nine-foot roads on new state highway construction. They are not sufficient to carry modern traffic. In some instances we have built a single strip of concrete eight or nine feet wide on one side of the road with the intention of building a strip of the same width on the opposite side the following season. But in this case the entire roadway must be graded, and culverts and the drainage system for a wide road installed. Therefore, the major portion of the cost of a wide road is expended at the time of the construction of a narrow road. The construction of half a road surface is an expensive proposition, as Pennsylvania would soon find out. The New York State Highway Department does not expect to design roads less than 16 feet in width in the future, except on thoroughfares of the least importance—and the trouble in this case is that heavy traffic follows improved highways, so that within a short time a minor hard-surfaced road becomes an important artery.

"I am proud of the Pennsylvania highway system as worked out by Commissioner Sadler. It is a marvel.

"Build your roads 18 feet wide and build the most important ones first. Counties in New York are building roads to connect with the main highways and they are doing a real job of it. The value of a small road is only in the value that it gets out of the main road."

Preventing Ice at Hydro-Electric Intakes

It is reported that the Ontario Hydro-Electric Commission is to carry out experiments in heating the waters of the St. Lawrence river at the entrance to the penstocks in order to avoid interference with the operation of the plant during the spring break-up of ice.

Recent Legal Decisions

PEDESTRIANS CROSSING EXCAVATED STREET MUST LOOK OUT FOR DANGERS CONNECTED WITH THE WORK

In an action against a paving company for injuries received while crossing a street excavated for paving, the Missouri Supreme Court holds, *Waldmann v. Skrainka Const. Co.*, 233 S. W. 242, that where the plaintiff knew that the work was unfinished, and a red light warned her to look out for dangers, she was put on notice and bound to look out for dangers connected with the work, including stumbling or tripping on the exposed edge of the sidewalk, which she knew she would have to encounter and step over in crossing the excavation. Her testimony was held to show that she was guilty of such contributory negligence as prevented her having any case for the jury.

WAIVER OF NOTICE TO BEGIN IMPROVEMENT WORK —TAX BILL VOID BY DELAY IN COMPLETION

The Missouri Supreme Court holds, *City of Brunswick v. Benecke*, 233 S. W. 169, that the giving of notice to begin work on a street improvement provided for by an ordinance may be waived by the contractor. His intention to waive notice need not be proved by express declarations, but may be shown by the acts and conduct of the parties from which an intention to waive may be reasonably inferred.

It is also held that where an ordinance under the Missouri statute, authorizing improvement of streets in cities, Rev. St. 1909, par. 9411, provided that the work should be completed within 60 days, and it was not completed within 135 days, there being nothing to show that it was not needlessly delayed, a tax bill issued for the work was void, although the ordinance contained a penalty proviso.

COMBINATION AMONG BIDDERS RENDERS MUNICIPAL CONTRACTS VOID

The Texas Court of Civil Appeals holds, *City Nat. Bank v. City of Corpus Christi*, 233 S. W. 375, that the council of the city of Corpus Christi acted within the bounds of a sound discretion in rejecting bids made by two banks seeking the position of city treasurer, where the evidence showed that there was a tacit agreement between the parties to obtain the use of the public funds for a less sum than would have been bid if such agreement had not been made. The court said: "It is the settled rule of the law that arrangements and combinations among prospective bidders for municipal contracts to prevent competition among themselves, and to bring about an award at a figure which is not the result of an honest competition, are contrary to public policy and void. Such contracts being illegal and void, no inquiry is necessary as to the particular ef-

fect of the contract. *Dillon, Mun. Corp.*, p. 1165, par. 781; *People v. Stephens*, 71 N. Y. 527; *McMullen v. Hoffman*, 174 U. S. 639, 19 Sup. Ct. 839, 43 L. Ed. 1117; *James v. Fulerod*, 5 Tex. 512."

CITY'S POWERS AS TO LICENSING AND REGULATION OF AUTOMOBILES FOR HIRE

The Florida Supreme Court holds, *State v. Dillon*, 89 So. 558, that the city of Miami has the right, under the provision of its charter, to require the drivers of all automobiles for hire using the public streets of the city, to obtain a license from the city, and, in the interest of public safety to inquire into and decide upon the qualifications and fitness of persons to operate cars. It may fix the rates to be charged for the transportation of persons or property, may require the drivers or owners of cars operating for hire within the city limits to give a bond to guarantee the payment of valid claims for injuries to persons or property, may prescribe the number of persons that may be permitted to ride at one time in any such automobile, and make reasonable rules and regulations governing the operation of automobiles for hire in the interest of public safety. The right to require a bond does not, however, authorize the requirement of a bond to an amount far in excess of what common experience teaches is likely to be necessary, nor to impose unreasonable conditions in the bond, or conditions that make it impossible for compliance with this provision of the ordinance. An ordinance providing for a \$5,000 bond, with a continuing liability thereunder of not less than the full amount, notwithstanding any recovery thereon, was held unreasonable, and not authorized by the city charter.

MUNICIPALITY NOT PREPARED TO EXTEND WATER MAINS TO CONSUMER CANNOT PREVENT CONTRACTS WITH ANOTHER

Where it appeared that the water-distributing system of a town was at its nearest point at least $4\frac{1}{2}$ miles from the plants of two corporations located within its limits, and it had taken no steps to extend its existing water mains so as to supply water to the corporations, the New Jersey Court of Errors and Appeals holds, *Town of Kearny v. Mayor and Council of City of Bayonne*, 114 Atl. 550, that the town could not restrain the execution of contracts between the corporations and another municipality for the furnishing of water, since the performance of these contracts could not work any present injury to the town, even if it had the exclusive right, under statute, to furnish water to the corporations; since a preliminary injunction will not be ordered unless from the pressure of a present urgent necessity, and the damage threatened to be done, and which it is legitimate to prevent during the pendency of the suit, must be, in an equitable point of view, of an irreparable character.

NEWS OF THE SOCIETIES

Dec. 5-8—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Omaha, Neb. Secretary, J. H. Mullen, St. Paul, Minn.

Dec. 5-9—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual convention. New York City.

Dec. 6-9—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. 14th annual meeting. Baltimore, Md.

Dec. 13—ENGINEERING SOCIETY OF BUFFALO. Iroquois Hotel, Buffalo. Secretary, N. L. Nussbaumer 80 W. Genesee Street, Buffalo.

Dec. 13-14—EASTERN PAVING BRICK MANUFACTURERS ASSOCIATION. Annual meeting. Pennsylvania Hotel, New York City.

Dec. 14—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies' building, New York City.

Dec. 15—ENGINEERS' CLUB OF CINCINNATI. Cincinnati.

Dec. 15—BRIDGEPORT BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Hotel Stratford. Secretary Arthur R. Parker, Watrous Engineering Co., Bridgeport.

Dec. 15—MERIDEN BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Home Club. Sec. E. W. Carruth, Aeolian Co., Meriden.

Dec. 15—TOLEDO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Loring Freed, Atlas Chemical Co.

Dec. 16—METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, G. I. Rhodes, 115 Broadway, N. Y. C.

Dec. 20—PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Chamber of Commerce. Secretary, Prof. W. H. Kavanaugh, Un. of Penn.

Dec. 22-23—KANSAS ENGINEERING SOCIETY. Annual meeting. Hutchinson, Kan. Secretary, J. M. Averill, Topeka.

Dec. 22-23—KANSAS ENGINEERING SOCIETY, Hutchinson Kan.

Dec. 27-30—AMERICAN ECONOMIC ASSOCIATION. Pittsburgh, Pa.

Dec. 27-31—AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SMITHSONIAN INSTITUTE, Washington, D. C. Toronto, Canada.

Jan. 4-14—CLEVELAND, OHIO, BUILDING EXPOSITION. Municipal auditorium, Cleveland, Ohio.

Jan. 5-6—AMERICAN ENGINEERING COUNCIL, FEDERATED AMERICAN ENGINEERING SOCIETIES. Annual meeting, Washington, D. C.

Jan. 17-19—IOWA ENGINEERING SOCIETY. 34th annual meeting. Sioux City. Secretary—Lloyd A. Canfield, Des Moines, Ia.

Jan. 17-19—ASSOCIATED GENERAL CONTRACTORS. 3rd annual meeting. Hotel Winton, Cleveland Ohio.

Jan. 17-20—ASSOCIATION OF CANADIAN BUILDING AND CONSTRUCTION INDUSTRIES. 4th annual conference. Royal Connaught Hotel, Hamilton.

Jan. 17-20—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual Convention and good roads show. Chicago, Ill.

Jan. 18-19—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting. New York City.

Jan. 27—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies' Bldg., New York City. Secretary—G. I. Rhodes, 115 Broadway, New York City.

Feb. 12-17—CONFERENCE OF HIGHWAY ENGINEERING. 8th annual conference. University of Michigan, Ann Arbor, Mich.

Feb. 15-17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Tenth midwinter convention. Engineering Societies' building, New York City.

Feb. 21-23—MINNESOTA FEDERATION OF ARCHITECTS AND THE MINNESOTA SOCIETY OF CIVIL EN-

GINEERS. First annual convention Curtis Hotel, Minneapolis.

Apr. 27-30—BUILDING OFFICIALS' CONFERENCE. Apr. 27-28, Cleveland, O.; Apr. 29, Massillon, O.; Apr. 30, Youngstown, O.

May 15-19—AMERICAN WATERWORKS ASSOCIATION. Annual convention. Philadelphia, Pa.

PROVIDENCE ENGINEERING SOCIETY

The Providence, R. I., Engineering Society at its meeting on November 15th was addressed by Alfred D. Flinn, secretary United Engineering Society, on "The Engineer's Road to Peace: Co-operation, Past, Present and Future."

NEW YORK ASSEMBLY, A. A. E.

At its meeting on November 12th in Albany the New York Assembly, A. A. E., elected the following officers: president, Germain P. Graham; vice-president, G. P. Hevenor; second vice-president, W. L. Everett; secretary-treasurer, J. G. Brennan.

IOWA SECTION, AMERICAN WATERWORKS ASSOCIATION

At its annual meeting on November 1, 2 and 3 in Omaha, the Iowa section, A. W. W. A., elected the following officers: chairman, J. Chris Jensen; vice-chairman, Peter Kern; directors, Harvey P. Letton and C. L. Ehrhart; and secretary-treasurer, Jack J. Hinman, Jr.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The Bridgeport branch of the A. S. M. E. will hold a meeting on December 15th, which will be addressed by Dr. Magnus W. Alexander, Chairman of the National Industrial Board on "World Wide Industrial Conditions."

The Meriden branch will also meet on this date at the Home Club. The subject of this meeting is "The Transportation and Storage of Coal." Harry R. Westcott, of Westcott & Mapes, New Haven, will address the meeting on "The Development of the Grand Avenue Station of the United Illuminating Company of New Haven."

Also on this same date is scheduled the meeting of the Toledo section. Features of this meeting will be an illustrated address on "Gas Manufacture, Distribution, etc." by A. Johnson, of the Atlas Chemical Co., Toledo, an address on "Industrial Fuel, by Henry O. Loebell, Henry L. Doherty Co., N. Y. C., and the showing of a motion picture film loaned by the American Gas Association.

The Metropolitan section will hold a meeting on December 16th, the subject of which is "Pulverized Fuel." In the afternoon the members will inspect the Babcock & Wilcox Boiler Co.,

Bayonne, N. J., followed by supper and a meeting in the evening. Speeches will be delivered on "Pulverized Fuel from the Operating Standpoint," by James A. Kinney, Bethlehem Steel Co., William J. Fantneyer, Puget Sound Power & Light Co., W. H. Maddocks, H. L. Kohlberg, H. R. Barnhurst, Fuller Engineering Co., Allentown, Pa., and H. D. Savage, Combustion Engineering Co., New York City.

On December 20th the Philadelphia section will hold a meeting in the form of a symposium on "Material Handling." This will be a joint meeting of A. S. M. E., Professional Division on Materials Handling, Philadelphia section of A. S. M. E., Engineers' Club of Philadelphia, Chamber of Commerce, A. I. E. E. and the Association of Iron & Steel Electrical Engineers.

PERSONALS

Barker, L. E., formerly engineer for the Pima County, Ariz., Highway Commission, has been appointed engineer with the Yavapai County Highway Commission.

McClelland, George A., has been appointed engineer of Harrison County, Texas.

Surman, H. E., formerly district engineer with the highway division of the Illinois Dept. of Public Works and Bldgs., at Dixon, has been appointed engineer in charge of design with the department, to succeed Frank T. Sheets.

Bowen, Carl T., has been appointed engineer and superintendent of roads in Ottawa County, Mich.

Elliott, John L., now senior assistant city civil engineer of Indianapolis, Ind., has been appointed city civil engineer by Lew Shank, newly elected mayor.

French, John V., has been elected mayor of Port Huron, Mich.

Whitford, Paul M., has been appointed superintendent of the Watchung, N. J., Water Co., to succeed Harry R. Cox, resigned.

Baker, George F., heretofore city engineer of Dayton, Ohio, has been appointed service director of that city. The position of city engineer is to be filled by Ivan E. Houck.

DeSavigny, H. J., has been transferred by the Saskatchewan department of highways from Weyburn to Swift Current.

Struthers, D. L., has been appointed highway engineer for Gaston county, with headquarters at Gastonia, N. C.

Dalton, E. L., of Dallas, Tex., has been appointed supervising engineer for water works improvements at Ferris, Tex., and for street improvements at Mexia, Tex.

Coe, Col. C. S., has been appointed city manager of Miami, Fla.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

FORDSON ROAD GRADERS AND TRACTORS

The road graders manufactured by the Wehr Company for operation by the Fordson Tractors are a combination grader and cleaner, designed to take the place of heavy, costly road equipment and can be operated under the most severe conditions, taking the place of the pony grader and enabling the road patrol to cover 20 miles per day instead of 8 miles per day.

The arrangement by which the operator is able to use the whole weight of the tractor provides a downthrust that is much more efficient than any scraper or road drag which merely rests on the surface of the road.

The cutting edge is below the power unit and ahead of the drive wheel. The distributing bar delivers the excess dirt and a 4-inch shoe allows the grade blade to deposit cuttings in low places. The 3-point toggle suspension gives absolutely independent movement for short turns, and backing is easy. The oscillating bar overcomes any uneven-



TWO TON TRAILER

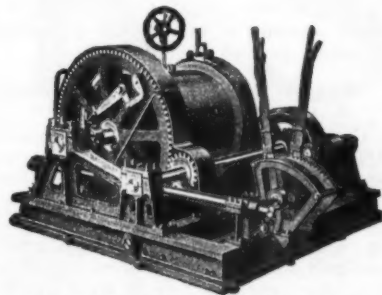
ness, and the 5-inch road clearance permits for passing over railroad tracks. The grader is quickly attached and detached to the tractor by a simple connection having only three bolts.

The manufacturers have just completed tests on a 2-ton trailer that carries one-third of the load on the rear of the tractor wheels and greatly aids the tractor and improves the traction. With this trailer the Fordson tractor will handle 2 tons under practically any condition and on 20 percent grades will pull the loads at second speed.

FLORY BAND FRICTION HOISTS

The Improved Type Band Friction made by the S. Flory Manufacturing Company, has been developed after many years experience with frictions and hoisting difficulties and transmits its power directly from the rim of the gear to the flanges on the drum, eliminating all torsional stress on the drum shaft. It remains locked when friction is in or out of contact, thus causing no end thrust in bearings or operating mechanism.

It consists of a simple system of levers actuating the rocker shaft to which the bands are fastened. The fulcrum of the bell crank rocker arm is placed on the spoke below the rim of the wheel to shorten the travel of the sleeve of the drum shaft. This construction reduces the distance between the gear and bearing to a mini-



FLORY BAND FRICTION HOIST

mum. The band is made in two pieces, each supported at one end by heavy pins, and the other ends are fastened to the rocker shaft. In case of accident to either half band the hoist can be operated with half the load at normal speed.

The operation consists in moving the sleeve along the drum shaft by either hand or mechanical power. To this sleeve is attached a connecting toggle link which actuates the rocker arm shaft, thereby tightening the bands. If hand operation is desired a lever is provided in the battery; if mechanically operated, air or steam cylinder is furnished and a valve controlling this is located at the battery of levers.

The single friction drum electric hoist, suitable for incline plane work, is equipped with the improved type band friction and one differential band brake with non-burnable lining. All gears have machine cut teeth. The drum is cast iron and bronze bushed where it runs loose on the shaft. The drum barrel is accurately balanced.

The housings are low and provided with long bearings lined with a high grade babbitt and making a rigid construction. Operating levers are equipped with brass thumb latches working in notched quadrants and mounted in a battery. The chain driven dial indicator is furnished only on request.

This hoist has the wide range of from 2,500 pounds to 18,000 pounds rope pull at a speed varying from 100 feet to 800 feet per minute.

ECONOMICAL MUCKING

The thirteen Meyers Whaley Shoveling Machines now installed on the main tunnel of the Hetch Hetchy Aqueduct for the San Francisco water supply are credited in the report of city engineer M. M. Shaughnessy, with unquestionably accounting for "the maximum progress with minimum cost for the work; the average cost of 2,915 feet of rock tunneling, exclusive of overhead and plant charge being \$27.46 per lineal foot, for labor and material."

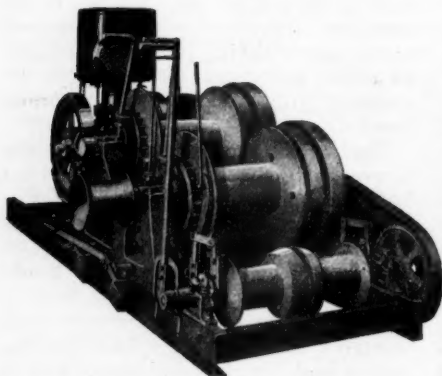


COMBINATION TRACTOR, GRADER AND CLEANER, WITH THREE POINT TOGGLE SUSPENSION

This tunnel, 11½ feet in diameter and 19 miles long, is blasted in sections 9 to 13 feet long, for which the drilling and shooting is done in 14 to 16 hours, simultaneously with the mucking. When executed by hand the mucking costs \$109.50 and takes 19 to 21 hours; by machine it costs \$33.00 and takes 3 to 5 hours, making a net saving per shoot of \$76.50 and 16 hours time.

O. K. HOISTING MACHINERY

Catalog 19 of the O. K. Clutch & Machinery Co., illustrates light and heavy duty single and double drum, light and heavy duty, geared hoists equipped with vertical gasoline engines or with horizontal kerosene engines, made in sizes of 3, 4½, 6, 8, 10 and 15 h.p., also reversible hoists with belt or engine drive and single or double drum hoists with electric motors.



DOUBLE DRUM HOIST WITH BOOM SWINGER AND VERTICAL ENGINES

It is claimed that the O. K. Hoists are built for constant duty, regardless of weather conditions and are self-contained, sturdy, simple, positive and reliable. They can be stopped or started quickly and easily and have cone asbestos lined friction drums requiring no adjustment, self oiling, phosphor bronze bushings and quick acting spring release, asbestos lined foot brakes.

All the hoists are equipped with end thrust ball bearings which reduce to a minimum, both friction and the power required for hoisting; something which it is claimed is not accomplished in any other type of hoists and which gives excellent results.

The gasoline engines are hopper cooled, frost proof with enclosed crank case, the lower portion of which serves as a gasoline reservoir supplying the carburetor and containing enough fuel for 10 hours' operation.

The heavy duty double drum geared hoists with vertical gasoline engine and equipped with double drum boom swinger used for derrick service, are made reversible or non-reversible and will lift from 1,500 to 2,800 pounds on a single line at a speed of 150 feet per minute.

ST. MARYS OIL ENGINES

Super-Diesel 4-cycle oil engines, manufactured by the St. Marys Oil Engine Co., are operated on heavy oil,

which gives an important economy over the fuel cost required for the same service for gasoline engines, and a still greater saving over steam engines. The engines are made in several types of 20 to 60 h.p., weighing from 8,800 to 22,370 pounds and occupying floor spaces of from about 9 x 14 to 10 x 11 feet. Small engines of 4½ to 9 h.p. are also built of this type for field power pumping units when combined with a water plunger. An engine of the 4½ h.p. size, when operated on crude oil at five cents per gallon is said to make an annual saving of \$512 over the cost of the same size gasoline engine operated on gasoline at twenty-five cents per gallon.

The large engines are made with one-piece cast bed of the deep box center crank type with large foundation areas and main bearings cast integral at an angle of 45 degrees, thus relieving caps and studs of all strain. All parts of the horizontal engine are accessible from the engine room floor, very much promoting the ease of inspection and adjustment. The standard equipment furnished includes air compressor, air receiver, water circulating pump, mechanical grease cups, fuel tanks and other items.

This engine is radical in its simplicity. It uses neither an ignition system, carburetor, fuel pump or torch. Magneto, batteries, coils, spark plugs, wire, the dangerous blow torch for heating hot bulbs, plates and tubes are all done away with. Through the absence of these devices ninety-nine per cent of all engine trouble is claimed to be eliminated. No accessory equipment whatever is required, simply turn on the oil, turn the engine over, and it starts at once, regardless of weather conditions. The St. Marys "Super-Diesel" oil engine is primarily designed to operate on kerosene, solar oil, fuel oil or any cheap distillate liquid enough to flow freely through the fuel pipes. The intake exhaust, and fuel admission valves are operated mechanically.

This engine runs practically at constant speed. It operates just as well under variable or steady loads. Speed control is maintained under varying loads by means of a throttling governor. The governor is connected with the fuel admission valve and automatically varies the amount of fuel in accordance with the load, thus maintaining a constant engine speed.

The first stroke is called the intake stroke. Fuel admission valve opens and oil under gravity, together with a slight amount of air, is admitted during this stroke into the fuel cup. This cup is a compartment on the inner end of the fuel valve assemblage and projects into the combustion chamber.

The next stroke is the compression stroke. When the compression becomes sufficient, ignition takes place in the fuel cup. The fuel cup is in direct communication with the combustion chamber proper. Air in the cylinder is forced into the fuel cup. The oil is changed to gas. A great amount of heat is generated. The air and oil gas expand and force the piston back.

Next in order is the power or expansion stroke. Power is transmitted from the piston through the connecting rod to the flywheels.

Finally there is the exhaust stroke. At the start of the exhaust stroke the exhaust valve opens and the burned gases are forced out.

INDUSTRIAL NOTES

The H. W. Clark Company announces an increase in its capital stock from \$75,000.00 to \$200,000.00 (\$150,000 common and \$50,000 seven percent preferred cumulative).

A one hundred per cent stock dividend was declared out of the earnings of the Company, and some of its common stock as well as some of the seven per cent cumulative stock is offered for sale.

EFFICIENCY OF DEMOUNTABLE TRUCK BODIES

E. C. Jarden, president of the Jarden Brick Co., Philadelphia, writes:

"We have been using the Fontaine Demountable Truck Bodies mounted on Packard Chassis for a period of about seven months. We have found them economical in the delivery of face and common building bricks for close local business in various ways.

The old method of handling face brick was for the truck to stand while being loaded, which required from 30 to 40 minutes and then to stand at the operation the same length of time while unloading, while with the demountable truck the body is loaded while the truck is on the street so that the chauffeur backs up and picks up the load requiring about 3 to 5 minutes and is on his way. On arriving at the job it requires about the same length of time to deposit the load piled up in an orderly manner without handling or breaking a brick.

The saving to us is accomplished in keeping the truck continually on the street and hauling twice as many face brick as the ordinary truck of same capacity the same distance. In addition the loaders are working constantly and not standing around between loads waiting for trucks to come in as heretofore.

In handling common brick or material that can be dumped, the saving in time is not as great although two or three additional loads can be hauled by saving in time of loading only. In addition there is no breakage and a saving in space where room is an object.* * *

Our bodies are made to hold 1,500 brick which is the most practical load for the equipment—and we find an advantage on short hauls as we effect a greater saving on them. The average saving over monthly periods is from 50c. to 75c. per m. brick.